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July 2014

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Recommended Citation

Unknown, "Ilva Shear " (2014). *Morgan Documents*. Book 180.
<http://digitalcommons.wpi.edu/ms077morgan-docs/180>

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ILVA SHEAR

BASICALLY, KINETIC ENERGY OF ROTATION IS:

$$K.E. = \frac{1}{2} I \omega^2 \quad \text{BY DEFINITION}$$

WHERE I = MOMENT OF INERTIA
 ω = ANGULAR VELOCITY

2. MOMENT OF INERTIA OF A MASS $I = \int r^2 dm = k^2 m$
 IS IN UNITS OF slug ft² or $\frac{lb}{ft} \text{ sec}^2 \times ft^2$
 $= \underline{lb \cdot ft \cdot sec^2}$

ANOTHER MEASURE OF MOMENT OF INERTIA IS Wk^2
 WHICH IS $\underline{I \times 32.2 \text{ ft/sec}^2} = \underline{lb \cdot ft^2}$

3. ω = RADIANS/SECOND, N = RPM $\therefore \frac{\omega \times 60}{2\pi} = N$
 OR $\omega \times 9.56 = N$

THEREFORE $K.E. = \frac{1}{2} I \omega^2$
 $K.E. = \frac{1}{2} (\underline{Wk^2}) \times \frac{N^2}{9.56^2} = \frac{Wk^2 N^2}{91.5 \times 32.2 \times 2}$
 OR $\boxed{K.E. = \frac{Wk^2 N^2}{5880}} \quad \underline{FT \cdot LB}$

4. A MACHINE (ILVA SHEAR) HAS A $Wk^2 = 151 \text{ FT}^2 \cdot LB$
 AT THE MOTOR SHAFT. HOW FAST MUST THIS MACHINE
 BE RUN NOMINALLY SO THAT WHEN 2480 FT·LB
 OF ENERGY IS GIVEN UP BY THE SYSTEM, THE
 SPEED DROP IS 50%?

5. $KE_1 = f(\omega_1^2)$; $KE_2 = f(\omega_2^2)$
 $\star KE_1 - KE_2 = f(\omega_1^2) - f(\omega_2^2) = f(\omega_1^2) - f[(1-x)\omega_1]^2$
 $KE_1 - KE_2 = f[1 - (1-x)^2] \omega_1^2 = [2x - x^2] f(\omega_1^2)$
 (where x = speed drop)
 $\therefore \underline{\Delta KE = [2x - x^2] KE_1 = \text{ENERGY GIVEN UP IN SHEARING}}$

WHERE $x = .5$, $2x - x^2 = 1 - .25 = .75$
 $\therefore KE_1 = \frac{\Delta KE}{.75} = \frac{2480}{.75} = 3310$

ILVA SHEAR, CONT'D

6. RETURNING TO ITEM 3 :

$$KE = \frac{Wk^N N^N}{5880}$$

$$\therefore N = \sqrt{\frac{5880 KE}{Wk^N}}$$

$$\therefore N = \sqrt{\frac{5880 \times 3310}{151}} = \sqrt{129000}$$

$$\boxed{N = 359 \text{ RPM}}$$

$$\frac{650}{60}$$

$$1.4 \times 60$$

$$Ca = 1.72 \text{ sec}$$

$$\frac{650}{60} \times 81.8 = 875$$

$$\frac{25}{60} \times 10.8 = 4.5$$

$$\frac{65}{2.7} \times 1.4$$

$$\frac{65.3}{6.58} = 10.1$$

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